



## SPECTRUM OF FINDINGS ON COLOR DUPLEX SONOGRAPHY IN PATIENTS WITH CLINICAL SUSPICION OF CHRONIC VENOUS INSUFFICIENCY

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**ABSTRACT** Chronic venous insufficiency of the lower limbs is characterized by symptoms and signs produced by venous hypertension due to structural and functional abnormalities of veins as a result of underlying reflux or obstruction that may eventually give rise to lower extremity edema, pigmentation pain, ulceration. The main objective is to study the spectrum of findings on colour duplex sonography in patients with clinical suspicion of CVI and to identify the patients who can be taken up for varicose surgery by locating and ruling out DVT in them.

**KEYWORDS :** Chronic venous insufficiency, deep vein thrombosis, color Doppler sonography

### INTRODUCTION

The term chronic venous insufficiency refers to the venous valvular incompetence in the superficial, deep and/or perforating veins. Incompetence of the vein valves permits reversal of flow and promotes venous hypertension in the distal segments. This form of venous dysfunction may be the result of recanalisation of thrombosed venous segments, pathological dilation of the vein or due to congenital absence of competent valves.<sup>1</sup>

Chronic venous insufficiency of the lower limbs (CVI) is characterized by symptoms which include aching, heaviness, leg-tiredness, cramps, itching, sensations of burning, swelling, the restless leg syndrome, dilatation or prominence of superficial veins, and skin changes and signs which include telangiectasia, reticular or varicose veins, edema, and skin changes such as pigmentation, lipodermatosclerosis, eczema, and ulceration.<sup>2</sup>

The most frequent causes of CVI are primary abnormalities of the venous wall and the valves and secondary changes due to previous venous thrombosis. Congenital malformations are rare causes of CVI. Because the history and clinical examination will not always indicate the nature and extent of the underlying abnormality (anatomic extent, pathology, and cause), a number of diagnostic investigations have been developed that can elucidate whether there is calf muscle pump dysfunction and can determine the anatomic extent and functional severity of obstruction or reflux.<sup>2</sup>

CVI may affect only the superficial veins or it may be sequelae to deep vein thrombosis. Deep vein thrombosis can cause pain and swelling of the affected limb and it may also cause structural damage to the valves of the deep veins, which results in post phlebitis syndrome.<sup>3</sup> DVT of the lower extremity is one of the most common cause of pulmonary embolism; which in turn is responsible for majority of the deaths.

Since the clinical signs and symptoms of deep venous thrombosis are nonspecific and even though clinical examination can lead to correct diagnosis in case of varicose veins, it is important to promptly perform objective testing to confirm the diagnosis and enable the institution of safe and effective therapy.<sup>4</sup>

The introduction of doppler ultrasound technique has irrevocably altered the diagnosis and treatment of CVI. Duplex ultrasound; complemented with colour flow imaging, has been validated as a sensitive and specific modality for the identification of superficial and deep vein thrombosis.<sup>5,6</sup> Valvular incompetence can be confirmed with spectral and colour doppler, and unlike photoplethysmography and APG, venous insufficiency can be localized to specific valve sites in the deep and superficial veins. Incompetent perforators can similarly be identified and mapped prior to intervention.

The present study aims to evaluate the role of colour flow duplex ultrasound in clinically suspected patients of CVI of the lower limbs.

### MATERIALS & METHODS

The present study included 50 patients who were referred to the

Department of Radiodiagnosis in a period of 2 years from January 2016 to January 2018 in the hospital attached to Madha Medical College & Research Institute.

### INCLUSION CRITERIA

- Clinically suspected cases of chronic venous disease.
- Patients who present with swelling and ulcers over the foot.

### EXCLUSION CRITERIA

- Antenatal patients
- Seriously ill patients

### METHODS

In all patients, the following protocol was followed: Detailed clinical history was elicited with reference to onset, duration, progress of the symptoms and risk factors. Review of all the previous radiological (chest radiograph, ultrasound of abdomen and pelvis, Doppler ultrasonography of lower extremities in patients with history of DVT and pathological investigations) was done. Standard examination would evaluate common femoral vein, superficial femoral vein, popliteal vein followed by calf veins. 7.5 MHz linear array transducer was used for femoral and popliteal venous segments and calf veins. Superficial venous system was assessed for SFJ and SPJ incompetence. For detection of incompetent veins, patients were examined in standing position facing the examiner supporting his/her weight on contralateral extremity. Veins were manually compressed (asked to cough, perform valsalva maneuver) and released suddenly and tested for reflux. In lower extremity venous imaging; in which vessels run parallel to the skin surface without tortuosity, all venous segments were encoded in blue and corresponding arteries in red.

### OBSERVATIONS

DVT and thromboembolic diseases are the most common indications for investigation of the peripheral veins, but venous insufficiency and vein mapping are also indications for examining the veins.

The present study was performed to assess the role of colour flow duplex in chronic venous insufficiency. It included the detection of thrombus and extent of its involvement, assessment of valvular incompetence, distinguishing between reflux and obstruction, characterization of the varicosities as primary or secondary to underlying DVT - thus helping to ensure safe and effective treatment.

Among the 50 cases studied for suspected venous pathology colour duplex showed positive findings in 42 cases; 2 cases showed other causes of symptoms; and 6 cases had normal findings.

### AGE

**Table 1: Distribution of study population based on age (n=50)**

AGE (in years)	Number	Percentage
< 40 years	4	8
41-45 years	31	62
46- 50 years	15	30

The mean age of cases with CVI in our study was 44.31 years. In a randomized controlled study *Belcaro G et al (2002) Italy*, found that venous abnormalities increased with increasing age<sup>7</sup>. In the *Edinburgh Vein Study (Evans, 1999)*, the prevalence of trunk varices rose from 11.5 % in persons aged 18 to 24 years to 55.7 % in the population between 55.64 years of age. The occurrence of skin changes in CVI depends on the patient's age as well<sup>8</sup>.

### SEX

Males contributed 38 (76 %) in our study with suspected venous abnormalities and also had a higher incidence 33 (78.57 %) of positive Doppler study and females contributed 12 (24 %) with 9 (75%) showing doppler features of chronic venous insufficiency.

**Table 2: Distribution of study population based on gender (n=50)**

Gender	Frequency	Percentage
Male	38	76
Female	12	24
Total	50	100

These findings correlate with the study done by Strandness et al (1983)<sup>9</sup> and Evans CJ et al (1999)<sup>8</sup> which showed a higher incidence of chronic venous insufficiency in males. In their study 66 % of the male patients had a positive study<sup>9</sup>.

### TYPE OF INVOLVEMENT

**Table 3: Distribution of study population based on the type of involvement (n=50)**

Side	Frequency	Percentage
Right side	12	28.58
Left side	26	61.9
Right & Left side	4	9.52

This is in correlation with the study conducted by Cockett, Niges and Thomas (1976)<sup>10</sup> who showed that the venous abnormalities were more common in the left extremity<sup>10</sup>. Also in a venographic study of the incidence of DVT, Stamatakis JD et al (1978) found that major thrombi occur more frequently in the left limb<sup>11</sup>.

### SYMPTOMS:

**Table 4: Distribution of study population based on the symptoms (n=50)**

Symptoms	Frequency	Percentage
Swelling	16	32
Varicosity	12	24
Pain	8	16
Ulcer	7	14
Varicosity and swelling	3	6
Varicosity and pain	2	4
Eczema	2	4
Total	50	100

In cases showing venous abnormalities; swelling (32%) and varicosity (24%) were the predominant symptoms. Among 18 patients with DVT the most common symptoms were swelling (55.56%), and venous ulcer (38.89%).

This correlates with the study by Glover G et al (1996) which had 40% of cases with unilateral leg swelling found positive for DVT, and DVT was evident in only 5% of patients in the absence of leg swelling. This is explained by the venous physiology that when the major venous channels are occluded, the resultant increase in venous pressure and volume manifest itself as edema<sup>12</sup>. This is in correlation with the study by Langefeld M et al (1987) who also found that leg swelling was the most common symptom in patients diagnosed to have DVT<sup>13</sup>.

In our study with doppler findings of DVT; history of prolonged hospitalization 5 (27.8%), trauma 3 (16.7%) were the most common factors and history of previous surgery in 2 (11%); no known predisposing factors in 8 (44.44%). In cases with other cause of varicosities occupational/ prolonged standing were common in 8 (33.33%); hereditary factors 5 (20.8%); trauma in 3 (12.5%) and no known predisposing factors noted in 8 (33.33%).

### DVT AND CHRONIC VENOUS INSUFFICIENCY LOCALISATION AND EXTENT OF THROMBOSIS

In the present study with 18 cases of DVT, 15 (83.33%) was localized

to the thigh or popliteal region. The distribution of thrombi in the present study are as follows- 5.56% in CIV, 22.22% in EIV, 61.11% in CFV, 72.22% in SFV, 44.44% in PV, 22.22% in ATV, 0% in PTV and 38.89% in the Superficial veins. This correlates with the study by Appleman PT et al (1987)<sup>14</sup> and Hill SL et al (1997) reported involvement of iliofemoral segment in 16%, CFV in 13%, SFV in 19%, PV in 18%, calf veins in 24% and superficial veins in 11%.<sup>15</sup>

Compressibility of veins was lost in all 18 case of DVT, presence of signal void even on augmentation was found in 13 cases with complete thrombosis. Eccentric flow was demonstrated in 5 patients with partial thrombosis. The above findings correlated with the study by Rose SC et al<sup>16</sup> in 1990.

Superficial vein thrombosis was found in 7 cases (38.89%) with GSV thrombus predominating, in which 4 cases showed extension to the deep venous system. In a study by Blumenberg RM et al (1997), superficial thrombophlebitis of the proximal GSV extended into common femoral vein in 8.6% cases, of which 10% embolised to the lungs<sup>17</sup>. Benedict PJ et al (1995) found that approximately one third of those who have only superficial phlebitis initially will eventually extend the thrombus to deep system via saphenofemoral junction or perforating veins<sup>18</sup>.

In our study 8 patients presented with venous ulcer (severe degree of CVI); of these 7 (87.5%) patients showed DVT (with superficial and deep venous reflux, mainly perforator incompetence). This was in correlation with study by Hussain RA et al (1995) who studied 65 patients with venous ulcers and found that 56 (i.e. 86%) showed DVT.

### DISTRIBUTION OF VARICOSITIES

**Table 5: Distribution of study population based on the distribution of varicosities (n=40)**

Side	Frequency	Percentage
Right side	12	30
Left side	25	62.5
Right & Left side	3	7.5

Varicosities along GSV predominated in our study, 30 cases (75%); and along SSV 14 cases (35%) were noted. Saphenofemoral junction incompetence was noted in 18 (45%), out of which 15 cases showed incompetence associated with dilation of superficial venous system. SPJ incompetence was noted in 9 (22.5%) cases of which 6 cases showed associated dilation/ varicosities of short saphenous vein. This is in accordance with the study by Engelhorn CA (2005) et al.

Perforator incompetence was seen in 31 (77.5%) cases of the 40 varicosity cases. Below knee, mid calf and above ankle perforators showed (20 cases each, 50%) equal incidence and distribution and were the most common. This correlated with the study by Dellis KT et al (1998).

### CONCLUSION:

Lower limb venous system pathology is a common occurrence and clinically presents either as DVT or a venous insufficiency situation which may be associated with considerable morbidity and mortality. Colour duplex assessment of peripheral veins gives diagnostically adequate anatomic and hemodynamic information. Doppler ultrasound provides a noninvasive and reliable method for examining the venous system, particularly with respect to the diagnosis of thrombus in symptomatic patients. Ultrasound has the advantage that the segments of deep and superficial systems can be examined and the direction of blood flow within each segment can be demonstrated. Compared to other modalities like contrast enhanced CT and MRV, Colour Doppler is much cheaper, reasonably accurate and much more widely available.

In the present study of 50 patients with suspected venous pathology, colour duplex sonography could identify the cause of symptoms in 42 patients. It was of immense importance and utility with respect to the following:

1. To differentiate between obstruction and valvular incompetence.
2. Accurate clot localization in cases with diagnosis of DVT.
3. Evaluation of the extent of thrombosis.
4. To define the location and extent of valvular dysfunction.
5. Easily evaluate the competence of SFJ and SPJ valves. To distinguish whether saphenous vein is involved and whether the involvement is confined to the venous tributaries or perforators.

6. Depicting anatomic variations, collaterals.
7. Excluding other causes of pain and swelling of lower limbs.
8. To confirm the diagnosis of valvular incompetence and venous insufficiency due to primary venous pathology or secondary to underlying DVT; and thus to ensure safe and effective therapy.

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